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ABSTRACT

The purpose of this research was to investigate the effects of initial consonants, especially /s/, on the pluralization of English nouns by both native English- and native Spanish-speaking first grade pupils. A test instrument consisting of nonsense syllable trigrams was constructed based on linguistic descriptions of English noun pluralization. Accompanied by visual stimuli, this instrument was administered to 120 six-year-old children in the El Paso area. Results of the data analysis indicate that there is no significant effect of initial /s/ on successful noun pluralization, although /s/ is more frequently associated with misarticulations in both singular and plural responses. Results are discussed in terms of linguistic rules for pluralization, differences between pluralization strategies of native English and native Spanish speakers, and sources of /s/ misarticulations. (Author)

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AN INVESTIGATION INTO LINGUISTIC CUES INVOLVED IN ENGLISH NOUN PLURALIZATION OF SIX-YEAR-OLD MEXICAN-AMERICAN CHILDREN

LUIZ F. S. NATALICIO
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August 1973

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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

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U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

Office of Education

National Center for Educational Research and Development

PREFACE

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BACKGROUND FOR THE STUDY

Children's acquisition of the rules governing English noun pluralization[1] has been the subject of several recent studies (Anisfeld and Tucker, 1967; Anisfeld and Gordon, 1968; Anisfeld, Barlow and Frail, 1968; Graves and Koziol, 1971; Natalicio and Natalicio, 1971). All of these studies can be said to stem from Berko's pioneering investigation (1958) into children's acquisition of various English morphological response classes (e.g., noun plurals, noun possessives, third person present tense verbs, and past tense verbs).

Berko (1958) presented Subjects (Ss) with pictures which depicted either nonsense or real English words and attempted to elicit an inflected form of the real or nonsense word which corresponded to the linguistic pattern provided by the experimenter (E). In the case of noun plurals, for example, Ss would be shown a picture of an animal-like creature and E would state, "This is a wug." S would then be shown a picture of two of the creatures and be asked to indicate what two of them would be called, i.e., "Now there is another one. There are two of them. There are two _____.", where S would be expected to fill in the blank with "wugs." Berko's Ss were preschoolers (12 girls and 7 boys ranging between

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[1]To clarify what is meant here by rules, English noun plurals may be formed by adding /-z/, /-s/, or /-ɨz/ to the singular, and it is the final phonological segment of the singular noun which determines which of the three forms is applied. The phonological rules for stating this process are as follows:

1. Pl → [+anterior, +coronal, +strident]

2. ∅ → [+voc, +high, -back, -tense] / [+strident, +coronal] _____ [+anterior, +coronal, +strident]

3. [+anterior, +coronal, +strident] → [∝ voice] / [∝ voice] _____

Thus, an English word such as dog or car is pluralized by adding a -z sound; cat or duck is pluralized with the addition of an -s sound; and church or bus with the addition of an -ɨz, vowel-consonant combination.

four and five years in age) and first graders (26 boys and 35 girls ranging from five and one-half to seven years of age). With specific regard to noun plurals, Berko's results may be summarized as follows: (1) Preschoolers and first graders pluralized nonsense and real words requiring the /-s/ and /-z/ variants 70% correctly or better, but less than 40% correctly when the nonsense and real words required the/-ɨz/ allomorph. (2) There were no sex differences. (3) First graders revealed greater mastery of English noun pluralization than did the preschoolers in her sample.

In discussing the results, Berko concluded that before the adult rule for pluralization is acquired, a single pluralization rule of the type, "a final sibilant makes a word plural," may be applied by children. Thus, a word ending in /s, z, š, ž, č, ǰ/ (all sibilants), requiring the addition of the /-ɨz/ allomorph, is not inflected because the final sibilant of the singular makes it seem to be already plural. In addition, Berko concluded that there is probably a more general rule of English phonology which states that inflectional endings added to English nouns and verbs assume the feature [+voice] or [-voice] which characterizes the final phoneme of the noun or verb to which it is attached. Thus, rule #3 expressed above [cf. footnote 1] would be a more general phonological rule applying to all inflectional endings, possessives, past tenses, and the like, and would not be restricted to noun pluralization.[2]

In addition to the findings, Berko's study represented a sifnigicant contribution to linguistic research methodology for two principal reasons:[3] (1) Her proposal for using nonsense syllables to examine the generalization of inflectional rules and thereby eliminating the possibility of given responses being the result of rote memorization, marked the beginnings of a new direction in linguistic research.

> We know that if the subject can supply the correct plural ending, for instance, to a noun we have made up, he has internalized a working system of the plural allomorphs in English, and is able to generalize to new cases and select the right form. If a child knows that the plural of witch is witches, he may simply have memorized the plural form. If, however, he tells us that the plural of *gutch is *gutches, we have evidence that he actually knows, albeit unconsciously, one of those rules which the descriptive linguist, too, would set forth in his grammar (Berko, 1958, p. 150).

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[2]See also Palermo and Molfese (1972) for an excellent discussion of further interpretations.

[3]See Natalicio and Natalicio (1969) for a more complete analysis of the Berko (1958) study.

(2) The application of techniques, i.e., research and statistical methods typical of psychology, to linguistics, where with a few exceptions behavioral science research designs had not previously been employed. The rapidly growing field of psycholinguistics owes much to early researchers such as Berko.

As mentioned above, Berko's research was the model for a large number of subsequent studies.[4] Some of these studies extended the investigation of various aspects of English morphology (with noun plurals playing a prominent role as they had in Berko's study) to different subject groups, e.g., the mentally retarded. Using Berko's test, Lovell and Bradbury (1967) tested English special school children between the ages of eight and fifteen. They found that normal Ss performed quantitatively better than retarded Ss; that there was a time lag differential between performance on real and nonsense words in both groups; and that retarded Ss demonstrated greater inability to generalize from real to nonsense words. Newfield and Schlanger (1968), using a slightly modified version of Berko's test (21 of Berko's nonsense syllables and 23 real words selected to parallel morphologically and phonologically the nonsense items), compared the order of acquisition of English morphology between 30 retarded and 30 normal children and obtained results which closely parallelled those of Lovell and Bradbury (1967). Dever and Gardner (1970) obtained results which corroborated those of Lovell and Bradbury (1967) and Newfield and Schlanger (1968) in their study of educable mentally retarded (EMR) and normal children, i.e., that the normal children scored higher than the EMR children, that scores increase with an increase in age, and that the /-s/ and /-z/ allomorphs for noun pluralization precede the /-iz/ allomorph in both normal and retarded children's performances. Dever (1972) then examined the feasibility of using Berko's methodology to predict the occurrence or nonoccurrence of morphological errors in the free speech of the educable mentally retarded. Using a revised version of the Berko instrument (including both real and nonsense words), he compared the results with data obtained from free speech samples, and concluded that performance on real words in a test of this type does not accurately predict the occurrence of morphological inflections in the free speech of educable mentally retarded children, although it permits a more accurate prediction than does performance on nonsense syllables within the same framework.[5]

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[4]There have also been two attempts to develop standardized tests which would assess the developmental level of English morphology using the paradigm developed by Berko: (1) Auditory-Vocal-Automatic (AVA) subtest of the Illinois Test of Psycholinguistic Abilities (McCarthy and Kirk, 1961); and (2) Picture Test of English Inflections (Chappell, 1968). Both of these tests use real words exclusively.

[5]For a more detailed discussion of the complexities of dealing with specific linguistic variables including noun plurals, in the free speech of children, see Cazden (1968).

Berko's methodology has also been extended beyond the constraints of English morphology by Kernan and Blount (1966) who designed a Spanish-language replication of the instrument to investigate the acquisition of Spanish morphology by Mexican children. Three items in the Kernan and Blount (1966) Spanish-language test involved noun plurals, and of interest is their finding that vowel-final nonsense syllables--pluralized in Spanish with the /-s/ allomorph--were pluralized more correctly (93.8%) than were consonant-final syllables--pluralized with the /-es/ allomorph--(44.7%).

Another group of investigations into the acquisition of English morphology within the general framework developed by Berko differed from those just described in that further modifications were made in the test instrument, procedures and/or subject samples in order to provide additional insights into various aspects of the acquisition process. One of the aspects of greatest interest was the distinction between productive (expressive) and receptive (comprehensive or recognition) control of English morphology; only the former had been investigated within the Berko paradigm. Cooper (1967), for example, devised a written English morphology test to study the differences between deaf and hearing children in both the receptive and productive control of derivational and inflectional rules. Controlling for reading level (i.e., above second grade level) of Ss, Cooper was able to determine that the use of the written test was comparable to an oral presentation in terms of measuring the ability of children to apply morphological rules for English inflectional endings, and that although hearing Ss' performances were strikingly superior, the patterns of item difficulty were similar for both groups.

Receptive versus expressive control was also of interest to Shriner and Miner (1968) who found no differences between disadvantaged and advantaged children to whom they had administered a test consisting of nonsense syllable stimuli designed to elicit both verbal production and comprehension. Twenty-five advantaged and 25 disadvantaged Ss matched for sex and mental age ranging in chronological age from two to six years, were tested. Of the twenty items in the expressive test, ten involved noun plurals, as did all items in the receptive test. It is important to note, however, that despite the fact that the noun plural was the predominant aspect of morphology tested, an attempt was made to minimize "phonological difficulties," and, as a result, all nonsense syllables which would have required the /-ɨz/ allomorph were eliminated from their selection of test items.

Bellamy and Bellamy (1970) also investigated both productive and comprehensive control of morphological inflections of regular nouns and verbs in English as well as the development of these inflections beyond age six. They tested children ranging in age from six to ten years on two aspects of production: ability to add inflection to nonsense words,

and ability to delete inflections; and two aspects of comprehension: ability to choose one of two supplied inflected nonsense words to fit a visual stimulus, and ability to select one of two pictures to fit a supplied inflected nonsense word. Their results involving noun plurals confirmed Berko's, i.e., that the /-s/ and /-z/ allomorphs are mastered earlier than the /-ɨz/ allomorph.

The third major group of studies which stemmed from Berko's work involve only one morphological ending, the noun plural, which in other studies had increasingly become the most salient morphological feature investigated (cf., for example, Shriner and Miner, 1968). Figuring most prominently here is Anisfeld who, with his collaborators, conducted a series of studies to investigate various aspects of noun pluralization.

Anisfeld and Tucker (1967) reported on a detailed investigation of the nature of the pluralization rules of six-year-old children. Both the extent of children's acquisition of the standard adult rules for pluralization and peculiarities in children's representation of the singular-plural relation were studied. Testing for the extent of children's acquisition of standard adult rules, an initial comparison of performance on a production task with that on a recognition task revealed that the number of errors with /-ɨz/ allomorphs (41%) was greater than errors with /-z/ and /-s/ allomorphs (28% and 32%, respectively) on the production task (again corroborating Berko's results); but that the /-ɨz/ allomorph accounted for fewer errors (19%) than the /-s/ and /-z/ allomorphs (36% and 28%, respectively) on the recognition task. A series of three experiments were then designed to explore further the possible peculiarities in children's representations of the singular-plural relation. First, an attempt was made to determine whether children considered the occurrence of a number preceding a noun as equivalent to pluralizing the noun. It was found that when children had a functioning inflectional rule (as evidenced by their correctly producing a plural noun) they omitted the preceding number in 27% of the cases; when the plural form was not known (as evidenced by their incorrectly producing it), however, the preceding number was omitted in only 9% o the cases. It was concluded that six-year-old children consider numbers as acceptable substitutes for noun plurals only when the plural marker is not known.

Secondly, an investigation was made to determine whether children possessed a pluralization rule of the form, "plurals are singular nouns with something added to them." It was concluded that even before adult pluralization rules are mastered, children possess a general rule of pluralization which does involve appending something to the singular noun, i.e., that plurals are longer than singulars.

The third study in this series attempted to investigate more thoroughly the extent of the child's acquisition of adult pluralization rules *via* three production and three recognition tasks which required Ss to produce and recognize both singular and plural nouns. It was found that in production tasks, the /-ɨz/ allomorph accounted for a greater number of errors than did the /-s/ and /-z/ allomorphs while in the recognition task /-z/ accounted for far fewer errors than did either /-s/ or /-ɨz/. Thus, the pattern of errors for the two distinct tasks (i.e., production and recognition) was different.

The two principal conclusions drawn by these researchers were: (1) Recognition and production tasks involve different aspects of a S's knowledge of noun plurals; they are not, as previously described, merely two degrees of difficulty within a single continuum. Production relies on actual pluralization rules while recognition permits Ss to rely on other generalizations about language, e.g., ". . . that plurals are longer than singulars and that few singulars end in /consonant + z/ clusters" (p. 1216). (2) All information available to Ss must be considered when attempting to analyze the results of isolated linguistic studies, i.e., in testing for the acquisition of noun plural rules, the fact that /consonant +z/ singular nouns rarely occur in English has a possible effect on Ss' responses.

Following up on the Anisfeld and Tucker (1967) investigation into the possibility that a child's pluralization rule involves nothing more than the notion that a plural is a singular with something added to it, Anisfeld and Gordon (1968) and Anisfeld, Barlow and Frail (1968) attempted to determine whether there were decided preferences on the part of children as to specifically what was added to the singular. Two alternative plurals for a given nonsense noun were provided Ss, and the children's preferences between the two alternatives were analyzed according to distinctive feature specifications. An examination of these specifications indicated that the features [+strident] and [+continuant] are most important in characterizing the plural marker, i.e., out of all the possible plural preferences expressed by Ss, plural endings containing these two features consistently were preferred over endings not containing these two features. Important is the fact that the plural endings /-s/ and /-z/ are both [+strident] and [+continuant]. It would thus appear that children do have a decided preference as to what constitutes an acceptable plural ending on the singular noun, and that the preference involves those features which characterize English plurals. Berko's (1958) notion that children view plurals as nouns which end in sibilants is confirmed by these results. Another important conclusion of these studies, that voicing is not an important distinguishing feature of

plurals, i.e., that children did not express consistent preferences for either [+voice] or [-voice] plural endings, lends support to one of Berko's alternative interpretations of the rule for voicing of plural suffixes, i.e., that the voicing rule of inflectional suffixes is a more general rule which relates to all suffixes and is not restricted to noun pluralization.

In another investigation of noun plural development in primary grade children, Graves and Koziol (1971) compared performance on both real and nonsense words and on regular and irregular words. Results obtained corroborated Berko's (1958) findings concerning the order of acquisition of English plurals, i.e., that /-s/ and /-z/ final plurals are acquired before /-ɨz/ plurals. These researchers found that the /-s/ and /-z/ allomorphs were acquired during or before the first grade, and the /-ɨz/ allomorph was not mastered until the third grade. They also found that children's performances were better for real words than for nonsense words and for regular words than for irregular words. No sex differences were found, corroborating Berko's (1958) findings.

Natalicio and Natalicio (1971) reported on a study of noun pluralization similar to the Graves and Koziol (1971) study except that the Ss were equally divided between native speakers of English (NES) and native Spanish speakers (NSS) who had learned or were learning English as a second language, in grades 1, 2, 3, and 10. Corroborating the findings of Graves and Koziol (1971), results indicated that NES Ss used the two plurals,/-s/ and /-z/,in the first grade, and that the third allomorph, /-ɨz/, was not consistently used by Ss until the third grade. The performances of NSS Ss indicated that the acquisition of the three plural allomorphs occurred in the same order as they had in the performances of their NES counterparts. The principal difference between the two language samples was that the NSS Ss evidenced a somewhat lower mean proportion of correct responses for the /-s/ and /-z/ allomorphs in the first and second grades, and, that not more than half of the final consonants requiring the /-ɨz/ plural allomorph were pluralized correctly by the NSS Ss in the third grade by which time their NES counterparts had attained almost 100% correctness. In short, the NSS Ss appeared to acquire English noun plural allomorphs in the same order as NES Ss, but because of their later start in learning English, there is a time lag of at least one year between their performances on noun plurals and those of the NES Ss.

An overview of all of the studies of noun pluralization reviewed here suggests two principal conclusions: (1) All results are remarkably consistent. Regardless of the modifications in instruments (e.g., written versus oral, real versus nonsense words), in procedures (e.g., elicitation of production versus recognition tasks), and in subject samples (e.g., retarded, deaf, Spanish speakers, disadvantaged), the results all tend to

support and contribute additional information to the original results obtained by Berko (1958). Not only have her results themselves been corroborated repeatedly by these studies, but many of the interpretations she made have been confirmed by subsequent investigations. (2) Because of the considerable number of studies conducted on the English noun plural and the data made available through these studies, the noun plural has been and continues to be a very fruitful aspect of English for investigation.

It should be mentioned here that, although not within the Berko paradigm and thus the scope of this study, there are other studies whose results would lend further support to the fact that the acquisition of English noun plurals appears to be a highly regular and predictable process, and one to which psycholinguistic analysis has been very successfully brought to bear. Ervin (1964), for example, in a longitudinal study of 31 preschool children found that they were able to use specific plural suffixes with real words before being able to adapt them to nonsense words, and that the /-s/ and /-z/ allomorphs were evident in performances before the /-ɨz/ allomorph.

The stability of the research procedures and the consistency of results obtained using the procedures to study noun pluralization warrant further exploration into areas not previously covered in earlier studies. One such area is that involving the possible influence of sibilants occurring in non-final position on the successful pluralization of English nouns. It will be recalled that one of the interpretations advanced by Anisfeld and Tucker (1967) concerning the less successful performance by small children in pluralizing sibilant-final nonsense syllables was that the sibilant ending on a singular noun might sound to the child like a plural because the plural markers are themselves sibilants. Thus, singular nouns ending in sibilants may seem to the child to have already been pluralized because of the sibilant sound occurring in final position. It will be recalled too that Berko (1958) spoke of plurals being words that end in final sibilants. If sibilants are thus identified by children as being related in some way to pluralization, a legitimate question might be raised concerning the role of sibilants when they occur in non-final position; i.e., do sibilants regardless of their place in a noun tend to interfere with a child's correct pluralization of a noun? Specifically, do sibilants when they occur initially in a nonsense syllable trigram lead the child to think, as they apparently do in final position, that the noun is a plural?

In reviewing the previous studies on noun pluralization, it is apparent that the focus has been on the final phonemes of the singular nouns in accordance with the linguistic rules formulated to describe English pluralization [cf. footnote 1]. Stimulus items are described in terms of final phonemes, and correct-incorrect pluralizations produced by Ss are

analyzed and discussed in terms of the linguistic rules. Further examination reveals that initial sibilants were not regularly included in the list of stimuli presented to Ss in noun pluralization tasks. Berko (1958), for example, has only two initial sibilants in her test, /z/, in the syllable /zib/, which is used to elicit the present progressive (zibbing), and /s/ in /spow/ to elicit a past tense verb; none is used to elicit a noun plural. Although the stimuli are frequently not included in research reports, the available data suggest that investigators assiduously avoided the use of initial sibilants in singular stimuli. If initial sibilants were systematically omitted from nonsense syllables used to elicit noun plurals, a possible conclusion is that previous researchers considered them to constitute a possible confounding variable.

The possibility that phonemes other than those in word-final position may have an effect on a child's success in performing a pluralization task is further suggested by research into language perception and production tasks, as well as by anecdotal evidence reported in a study on the training of noun pluralization (Guess, et al., 1968).

Palermo and Molfese (1972) point out that consonant sounds that involve the features of continuancy and stridency represent one of the three principal production difficulties evidenced by children between the ages of five and eight years. These two features, it will be recalled, characterize English sibilants. It is not yet clear whether the problem with these consonants is one of acoustic discrimination or of actual articulation, but it is obvious that sibilants are unstable consonants and are subject to considerable confusability at the age levels involved in noun pluralization studies.

Concerning such confusability of sounds, Brown (1969) investigated the identification of initial /l/ and /r/ in English trigrams by native speakers of Japanese, for whom the lateral and non-lateral distinction marking English /l/ and /r/ presents a high degree of confusability. Among his findings was that the final consonant context of the trigram had a significant effect on the identification of initial /l/ and /r/. Three consonants, /θ/, /ð/, and /s/, occurring in final position corresponded to significantly lower initial /l/ and /r/ identification scores than did final /l/ and no final consonant (p. 21). Brown interpreted these results to indicate that Japanese speakers were not in control of either basic cue detection, or the low level automatic processing of context-variable cues into stable cues which would permit perception independent of context (p. 61). Thus, there appears to be evidence that the perception and production of consonants can affect or be affected by non-immediate aspects of the linguistic environment in which they occur.

Guess, et al. (1968) reported that a possible confounding variable in the performance of a child being trained via operant procedures in English plural formation was the initial sound of the word. During training S was reported to have had greater difficulty pluralizing words

with an initial /s/, than words beginning with other consonants, /p/ and /d/.[6]

It will be recalled that Anisfeld and Tucker (1967) emphasized that the researcher should be careful to consider all information to which Ss may have access, not merely those data which are the focus of a given study, e.g., in considering successful recognition of noun plurals, the possibility that Ss respond to the mere fact that plurals are longer than singulars must be seriously considered. Sibilants, identified as they are with noun pluralization, present another possible information source to Ss, and their effect, if any, on noun pluralization when occurring in initial position must be investigated.

It is within this framework, i.e., that of examining another of the possible factors affecting Ss' responses to a noun pluralization task, that the present study was designed and conducted. Its purpose was to investigate the effects, if any, of initial consonants, especially sibilants, on the successful pluralization of English nouns by both native English and native Spanish speaking Ss. English noun pluralization has traditionally been viewed solely in terms of final phonemes. If other linguistic cues such as initial phonemes are found to affect significantly the pluralization task for the developing child, a consideration of these phenomena must be incorporated, for example, into the revision and elaboration of language instruction materials and practices for the early elementary grades. Further, for the second-language learning Mexican-American child, the importance of increased precision in the specification of linguistic cues is all the more important in the light of the double set of often conflicting cues with which he must deal during his early school years.

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[6]In a previous study (Natalicio and Natalicio, 1971), the present authors also noted an apparent effect of initial /s/ on successful noun pluralization, although, as in the case of the Guess et al. (1968) study, this evidence remained anecdotal.

METHOD

Instrument

A test instrument to permit the examination of the effects of initial consonants, especially sibilants, on the successful pluralization of English nouns was developed as follows:

1. Nonsense syllables were selected over real word stimuli. Nonsense syllables appear to eliminate possible rote learning effects on Ss' performances on a pluralization task (cf. Berko, 1958, p. 150). The elimination of such effects was particularly desirable in this study because of the obvious differences in prior language experiences (i.e., native English versus native Spanish speaking backgrounds) of the two groups of children who served as Ss.

2. Consonant-vowel-consonant (CVC) trigrams were chosen over more complex stimuli (e.g., CCVC or CVCC) to isolate the variables of interest, and to make results compatible with those obtained in earlier studies of noun pluralization.

3. /s/ was selected to represent the six sibilant consonants whose effects on noun pluralization when occurring in initial position were being examined. Of the English sibilants, /s/, /z/, /š/, /ž/, /č/, and /ǰ/, /s/ offered the greatest ease in articulation for both native English and native Spanish speaking Ss.

4. Serving as the control initial consonants were /b/ and /n/. These two consonants were chosen according to two main criteria: (1) that they presented the same relative ease of articulation for both NES and NSS Ss; and (2) that they differed as much as possible from /s/ in terms of their distinctive feature specification, i.e., /n/ differs from /s/ in that it is [+nasal] and [-continuant]; /b/ differs from /s/ in that it is [-coronal], [-continuant], and [-strident].

5. Three vowels, /i/, /a/, and /u/, were chosen because they represent primary distinctions in English vowel features, namely, the features [back], [high], and [low].

6. The final consonants of the trigrams were all twenty-four of the English consonants.

7. The twenty-four English consonants which were to serve as trigram finals were separated according to the allomorph required to pluralize them. These three groups of final consonants are:

A. /p, t, k, θ, f/, all of which are pluralized with /-s/;
B. /s, z, š, ž, č, ǰ/, pluralized with /-ɨz/;
C. /b, d, g, ð, v, m, n, ŋ, l, r, w, y, h/, all of which are pluralized with the /-z/ allomorph.

From each of these three groups, consonants were randomly drawn to derive three sets, each containing as equal a representation of each of the three original groups as possible:

Set 1: /θ, ǰ, n, b, p, z, y, r/, containing 2 phonemes from group A, 4 from group B, and 2 from group C above.

Set 2: /f, s, v, k, ž, m, d, h/, containing 2 phonemes from group A, 4 from group B, and 2 from group C above.

Set 3: /t, č, ð, ŋ, š, l, g, w/, containing 1 phoneme from group A, 5 from group B, and 2 from group C above.

8. The three versions of the test instrument were then constructed by combining one of the three initial consonants (/s/, /b/, or /n/) with one of the vowels (/a/, /u/, or /i/) and one of the three random final consonant sets (Sets 1, 2, and 3 of the preceding paragraph); the second of the three initial consonants with the second vowel and the second random final consonant set, and so on. This procedure for deriving the twenty-four nonsense syllables for each of the three versions of the test instrument is graphically depicted in Figure 1. The nonsense syllables derived in this manner for each of the three test versions appear in Figure 2.

Instrument Version 1	Instrument Version 2	Instrument Version 3
/b/ + /a/ + set 1*	/n/ + /i/ + set 1	/s/ + /u/ + set 1
/n/ + /u/ + set 2**	/s/ + /a/ + set 2	/b/ + /i/ + set 2
/s/ + /i/ + set 3***	/b/ + /u/ + set 3	/n/ + /a/ + set 3

*set 1 = /θ, ǰ, n, b, p, z, y, r/
**set 2 = /f, s, v, k, ž, m, d, h/
***set 3 = /t, č, ð, ŋ, š, l, g, w/

FIGURE 1. Construction of Nonsense Syllables for Three Versions of the Test Instrument.

Instrument Version 1	Instrument Version 2	Instrument Version 3
/baθ/	/niθ/	/suθ/
baǰ	niǰ	suǰ
ban	nin	sun
beb*	neb	sub
bap	nep	sup
baz	niz	suz
bey	ney	suy
ber	ner	sur
nuf	saf	bif
nus	sas	bis
nuv	sav	biv
nuk	sek	bik
nuž	saž	biž
num	sam	bim
nud	sad	beyd
nuh	sah	bih
sət	but	nɔt
sič	boč	nač
sid	bud	nad
seŋ	buŋ	naŋ
siš	boš	naš
sil	buwl	nal
sig	bug	nag
siw	buw	new

*To conform to the nonsense syllable criterion, all combinations of initial consonant, vowel, and final consonant which resulted in a meaningful English word were modified by minimal changes in the vowel.

FIGURE 2. Nonsense Syllables Contained in each of the Three Test Versions

9. Thirty-five illustrations "depicting" nonsense syllables which had been successfully used in an earlier noun pluralization study (Natalicio and Natalicio, 1971) were again utilized. No written text appeared on these illustrations; all linguistic stimuli were purely auditory. A black and white reproduction of one of these brightly colored illustrations is presented in Figure 3.

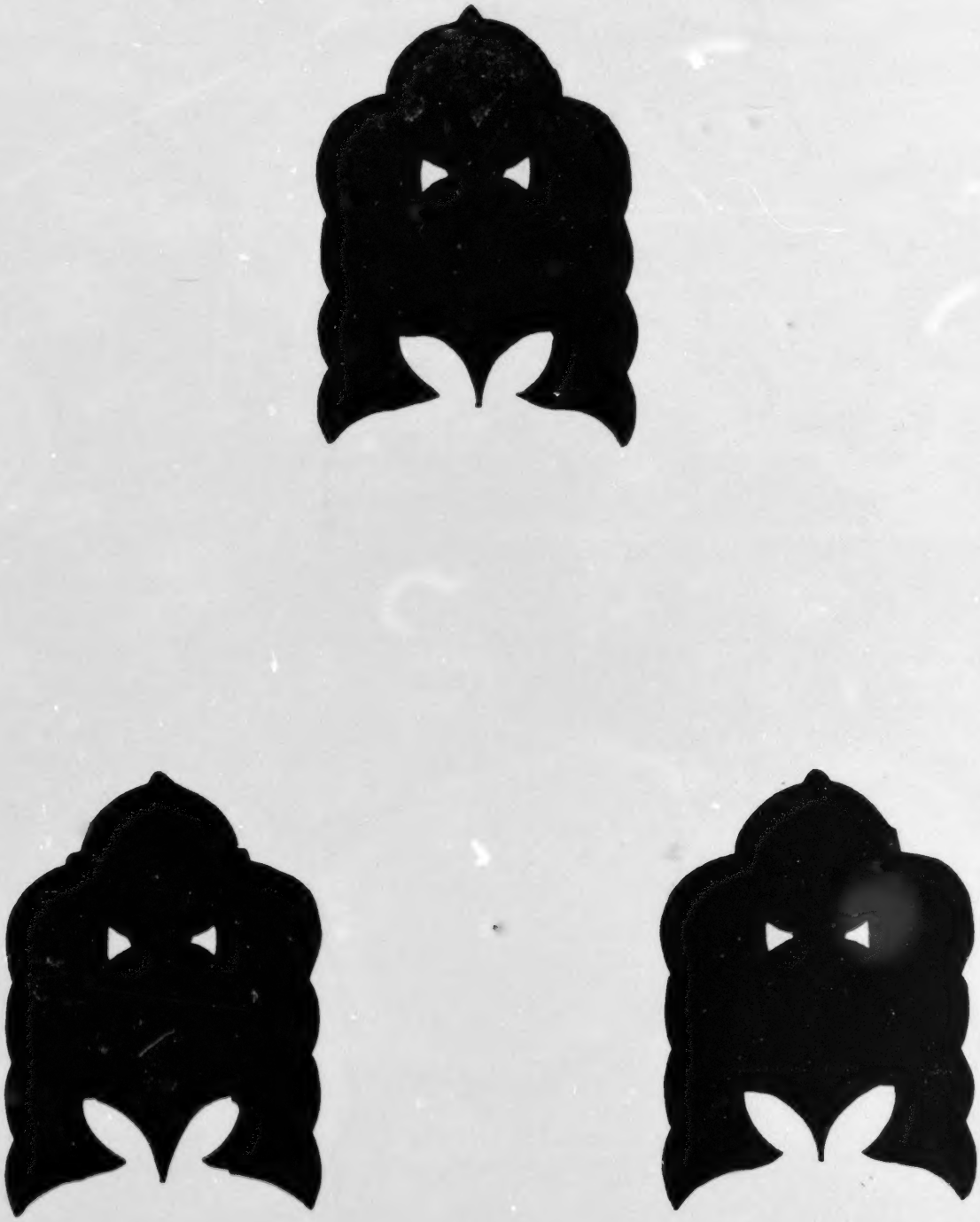

FIGURE 3. One of Thirty-five Illustrations "Depicting" Nonsense Syllables Used to Elicit Noun Plurals.

Subjects

A sample of 120 six-year-old first-grade pupils, equally divided between native speakers of English and native speakers of Spanish, with males and females represented equally within the two sub-samples, were drawn from two elementary schools in the El Paso area. The breakdown of Ss was:

	Native English Speakers (NES)	Native Spanish Speakers (NSS)
Male	30	30
Female	30	30

All Ss were within normal ranges of aptitude, none had speech or hearing disabilities, and all could be characterized as being in the lower middle SES bracket.

Procedures

Each of the three test versions of 24 nonsense syllable items was to be administered to ten Ss in each of the S cells (e.g., 10 NES males, 10 NSS males, and so on). Accordingly, S response sheets were prepared in advance, ten of each test version for each of the S cells; codes were entered on these response forms to ensure that Ss and test versions were appropriately matched. The preparation of response sheets also included entering the nonsense syllables of a given test version on each S response sheet in a randomized order; thus, no two test forms for a given test version were alike. The sequence of illustrations was also randomized before each administration of the test.

E provided S with instructions concerning the task using as an example the nonsense syllable /wəg/. Additional examples (using /mef/ and /muk/) were provided if E determined that S did not understand the first example; in only two cases were these additional examples necessary. When it was determined that S understood what was expected of him, E began the testing by referring to the first illustration and stating: "This is a _____. What is it? Now there is another one. There are two of them. There are _____." Ss were expected to repeat the singular stimulus[7] and then provide a plural. This procedure was continued until all 24 items, each

[7]See Natalicio and Natalicio (1969) for a more complete discussion of the desirability of singular repetitions.

accompanied by an illustration, were tested.

Ss' responses, both singular and plural, were transcribed by E on the response sheet, and tape recordings were made of all testing sessions for subsequent verification of E's transcriptions.

Pilot Testing of Test Instruments and Procedures

A pilot study of test instruments and procedures was conducted during the summer of 1972. The purpose of this pilot study was to ascertain the appropriateness of the nonsense syllables comprising the test instrument, to evaluate interview procedures, and to provide the research staff with experience in administering the test and coding and processing the data.

The Ss participating in the pilot test were forty pupils enrolled in the Summer Learning Centers of the El Paso Independent School District. Of these 40 pupils, 20 were native English speakers and 20 were native speakers of Spanish.

A process evaluation was carried out on the interview procedures and the test instrument used in the pilot study. As a result of this evaluation, the following modifications in procedures were deemed appropriate: (1) that prior to beginning the test additional time be spent conversing with Ss to put them more at ease; (2) that there be a short pause after items 8 and 16 to eliminate the monotony which sometimes resulted when a child responded to 24 items in succession (this pause to consist in talking to the child about the illustrations). In addition, one change was made in a nonsense syllable in Version 2 of the test instrument: the nonsense syllable /sek/ was changed to /seyk/ because the plural of /sek/, i.e., /seks/, was deemed inappropriate. Finally, one illustration was eliminated from the set of 35 because it did not qualify as a depiction of a nonsense syllable; i.e., several of the Ss participating in the pilot test identified the illustration as a "butterfly." All of the other items, illustrations, and procedures were deemed appropriate based upon the experience of the pilot study.

The data obtained during the pilot study were coded and subjected to various statistical analyses. The result of these analyses was the decision to modify the original plan for data analysis from a chi-square design to one involving analysis of variance procedures.

RESULTS

Scoring and Coding the Data

All noun plural responses for Ss were coded as either correct or incorrect. For each S there were 24 such scores, one for each of the 24 items in the test.

As mentioned previously, there were four S cells (NES males, NES females, NSS males, and NSS females) with 30 Ss in each of the cells. Of the 30 Ss in each of these four cells, ten were administered Version 1, 2, and 3 of the test, respectively. Data were grouped for analysis accordingly.

The principal question being considered in this study was the effect, if any, of initial /s/ on successful noun pluralization. In order to conduct this analysis, both correct and incorrect pluralizations of given final consonant sets as well as the initial consonants with which these final consonants were paired had to be examined. Accordingly, each correct or incorrect pluralization recorded for each S was considered not only in terms of the final segment to which the plural form related, but also of the initial consonant which had been paired with the particular final phoneme when the S either correctly or incorrectly pluralized it. In order to clarify results presented here, it is necessary to provide a brief explanation of the derivation of the scores used in the analyses.

Derivation of Scores

It will be recalled that in deriving the test instrument, there were three groups of final consonants, so grouped because when occurring in final position in a noun, all are pluralized with the same allomorph. Thus, the first such group, pluralized with the /-s/ allomorph, consisted of /p/, /t/, /k/, /θ/ and /f/; the second group, those consonants requiring a /-z/ allomorph, included: /b/, /d/, /g/, /ð/, /v/, /m/, /n/, /ŋ/, /l/, /r/, /w/, /y/, /h/; and the third group, taking the /-ɨz/ plural allomorph, included: /s/, /z/, /š/, /ž/, /č/, /ǰ/. It will also be recalled that these three groups were redivided so that as equal a number of consonants as possible from each of the preceding groups would be represented in each of the three final consonant sets which were paired with initial consonants and vowels to derive the three alternative test versions. This procedure resulted in there being in each test version all 24 final consonants, eight paired with each of the three initial consonants, /s/, /b/, and /n/. Since there are three groups of final con-

sonants paired alternately with these three finals, nine initial + final consonant scores per S were derived from the 24 responses scored for each individual S. In other words, each S was given the opportunity to respond to all nine possible pairings of the three initial consonants with each of the three final consonant groups which share the same plural allomorph. Thus, Ss to whom the three versions were administered had nine scores based on the pairings depicted in Figure 4.

	Final group 1 /p,t,k,θ,f/	Final group 2 /b,d,g,ð,v,m,n,ŋ,l,r,w,y,h/	Final group 3 /s,z,š,ž,č,ǰ/
Version 1 (9 scores) based on:	Initial /s/ + t	Initial /s/ + g,ð,ŋ,l,w	Initial /s/ + š,č
	Initial /b/ + p,θ	Initial /b/ + b,n,r,y	Initial /b/ + z,ǰ
	Initial /n/ + k,f	Initial /n/ + d,v,m,h	Initial /n/ + s,ž
Version 2 (9 scores)	Initial /s/ + k,f	Initial /s/ + d,v,m,h	Initial /s/ + s,ž
	Initial /b/ + t	Initial /b/ + g,ð,ŋ,l,w	Initial /b/ + š,č
	Initial /n/ + p,θ	Initial /n/ + b,n,r,y	Initial /n/ + z,ǰ
Version 3 (9 scores)	Initial /s/ + p,θ	Initial /s/ + b,n,r,y	Initial /s/ + z,ǰ
	Initial /b/ + k,f	Initial /b/ + d,v,m,h	Initial /b/ + s,ž
	Initial /n/ + t	Initial /n/ + g,ð,ŋ,l,w	Initial /n/ + š,č

FIGURE 4. Bases for the Derivation of 9 Individual Scores for Ss to whom Three Test Versions were Administered.

Since within each cell of 30 Ss there were ten Ss assigned to each of the three test versions, the total number of responses to each individual pairing of initial and final (3 X 3) were identical for all S groups.

Looking at these scores in terms of the independent variables of language group (NES and NSS) and sex, the group scores were in all cases the proportion of correct responses to the total possible responses in each of the cells which appear in Figure 5.

	Native English Speakers		Native Spanish Speakers	
	Males (N=30)	Females (N=30)	Males (N=30)	Females (N=30)
Initial /s/				
+p,t,k,θ,f	50	50	50	50
+b,d,g,ð,v,m,n, ŋ,l,r,w,y,h	130	130	130	130
+s,z,š,ž,č,j	60	60	60	60
Initial /b/				
+p,t,k,θ,f	50	50	50	50
+b,d,g,ð,v,m,n, ŋ,l,r,w,y,h	130	130	130	130
+s,z,š,ž,č,j	60	60	60	60
Initial /n/				
+p,t,k,θ,f	50	50	50	50
+b,d,g,ð,v,m,n, ŋ,l,r,w,y,h	130	130	130	130
+s,z,š,ž,č,j	60	60	60	60
Totals	720	720	720	720

FIGURE 5. Total Possible Correct Plural Responses Making up the 9 Scores for each of the Four Subject Groups.

Quantitative Analysis

In the interest of ease of interpretation, results of the analysis of greater complexity as well as generality will be reported first. The data (nine scores per S) were submitted to a 2 x 2 x 3 x 3 analysis of variance design where the Between Ss variables were language (NES and NSS) and sex (male and female), and where the Within Ss variables were plural allomorphs (/-s/, /-z/, and /-ɨz/) and initial consonants (/s/, /b/, and /n/). This design is depicted in Table 1 wherein are presented the mean scores[8] of each of the S groupings for each of the nine different variables (i.e., plural allomorph /-s/ with initial consonants /s/, /b/, and /n/, respectively; plural allomorph /-z/ with initial consonants /s/, /b/, and /n/; and plural allomorph /-ɨz/ with the same three initial consonants. Analysis of variance results are depicted in the source table presented in Table 2.

As anticipated, and consistent with the findings of Natalicio and Natalicio (1971), a significant difference between language groups was found ($F = 22.6047$, $p < .001$ with 1, 119 df). The mean for the native English speaking (NES) group was .5718 as compared to the mean of the native Spanish speaking (NSS) group which was .3529. Noteworthy here is the fact that the comparable means reported in the Natalicio and Natalicio (1971) study (using male Ss exclusively) were .6968 for NES first graders and .6296 for NSS Ss in the first grade.

A totally unanticipated result, not previously reported in the relevant literature, was a significant sex difference, ($F = 10.0933$, $p < .01$ with 1, 119 df). The mean for males was .5355, and the mean for females was .3893. Beginning with Berko's study (1958), sex differences, when they have been examined, have consistently been non-significant (cf. Graves and Koziol, 1971). In fact, many researchers subsequent to Berko including, for example, the highly creative study conducted by Anisfeld and Tucker (1967), did not include sex as one of the independent variables in their research, accepting apparently earlier findings of no sex differences. It would appear from the current findings that no assumptions can safely be made concerning absence of sex differences in tasks such as the one investigated here.

As indicated earlier, the language group means obtained in this study were considerably lower than those obtained in a previous study (Natalicio and Natalicio, 1971), namely, NES mean in this study, .5718, and in the prior study, .6968; NSS mean in this study .3529, and previously, .6296. One possible factor affecting these means is that in the prior study only male Ss were used, while here both male and female Ss (in equal numbers) participated. Since there was a significant sex difference in the data

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[8]As previously noted, all scores are expressed as "proportion correct" and may range from 0.0 to 1.0.

TABLE 1. MEANS OF EACH S SUBGROUP FOR EACH OF NINE VARIABLES

	Plural Allomorph /-s/			Plural Allomorph /-z/			Plural Allomorph /-iz/		
NES	IC /s/	IC /b/	IC /n/	IC /s/	IC /b/	IC /n/	IC /s/	IC /b/	IC /n/
Male	.7833	.8000	.7000	.7850	.7933	.8166	.4000	.4333	.4833
Female	.7000	.5666	.5333	.6566	.5383	.6366	.2666	.2000	.2000
NSS									
Male	.5833	.6500	.6500	.5300	.5366	.5283	.0166	.0833	.0666
Female	.5166	.4333	.3333	.3916	.3683	.4000	.0666	.0666	.1333

LEGEND: IC = Initial Consonant
NES = Native English Speaker
NSS = Native Spanish Speaker

TABLE 2. ANALYSIS OF VARIANCE SOURCE TABLE

SOURCE	df	SS	MS	F
Total	1079	194.7100		
Between Ss	119	85.5097		
Language (L)	1	12.9254	12.9254	22.6047***
Sex (S)	1	5.7714	5.7714	10.0933**
L - S	1	.4834	.4834	.8454
S_W/L - S	116	66.3295	.5718	
Within Ss	960	109.2003		
Initial Consonant (IC)	2	.0815	.0408	.6857
Plural Allomorph (Pl.)	2	36.8934	18.4468	153.8515***
IC - Pl.	4	.6009	.1502	2.5986*
IC - L	2	.1186	.0593	.9966
IC - S	2	.5501	.2751	4.6235**
IC - L - S	2	.0211	.0105	.1765
Pl. - L	2	.5961	.2981	2.4862
Pl. - S	2	.4108	.2054	1.7131
Pl. - L - S	2	.9980	.4990	4.1618*
IC - Pl. - L	4	.0498	.0125	.2163
IC - Pl. - S	4	.1709	.0427	.7388
IC - Pl. - L - S	4	.2702	.0676	1.1696
IC - S_W/L - S	232	13.8080	.0595	
Pl. - S_W/L - S	232	27.8177	.1199	
IC-Pl. - S_W/L - S	464	26.8132	.0578	

* $p < .05$
** $p < .01$
*** $p < .001$

reported here, with females performing less successfully than males, the difference between language group means may be accounted for, at least in part, by the sex difference. This observation is further supported by the fact that no significant language group X sex interaction was found, since in both language groups males performed more successfully than did females. The male-only means for the two language groups in this study were for NES males, .6660, and for NSS males, .4049. At least as far as the NES males are concerned, the means between the two studies become more compatible.

As will be noted in the source table, the difference between the initial consonants, /s/. /b/, and /n/, is not significant.

The results on the plural allomorph in this study corroborate previous findings, e.g., Berko, 1958, Anisfeld and Tucker, 1967. The mean for the plural allomorph /-s/ was .6041; for /-z/, .5817; and for /-ɨz/, .2103. There is a significant difference between these means with $F = 153.8515$ ($p < .001$ with 2, 232 df). Ss in this study confirmed earlier conclusions that /-s/ and /-z/ are observed in children's performances before /-ɨz/.

The initial consonant X plural allomorph interaction was found to be significant with $F = 2.5986$ ($p < .05$ with 4, 464 df). The means for the various levels of initial consonant X plural allomorph are presented in Table 3. The interaction itself is graphically shown in Figure 6.

TABLE 3. MEANS FOR INITIAL CONSONANT X PLURAL ALLOMORPH INTERACTION

	Initial Consonant		
Plural Allomorph	/s/	/b/	/n/
/-s/	.6458	.6125	.5541
/-z/	.5908	.5591	.5954
/-ɨz/	.1875	.1958	.2208

As can be seen in Table 3, the lowest mean is that for initial consonant /s/ with plural allomorph /-ɨz/, while the highest mean is that for initial

consonant /s/ with plural allomorph /-s/. This finding at best provides contradictory evidence with regard to the question of the effects of initial consonant on the inflection of the plural allomorph, for the most parsimonious interpretation would point to the plural allomorph /-ɨz/ as a responsible factor vis-à-vis low level performance in pluralization. That is, the lowest three means in Table 3 are those associated with the plural allomorph /-ɨz/ regardless of the initial consonant with which it was paired. On the basis of this finding, there is no apparent effect of initial consonant on pluralization.

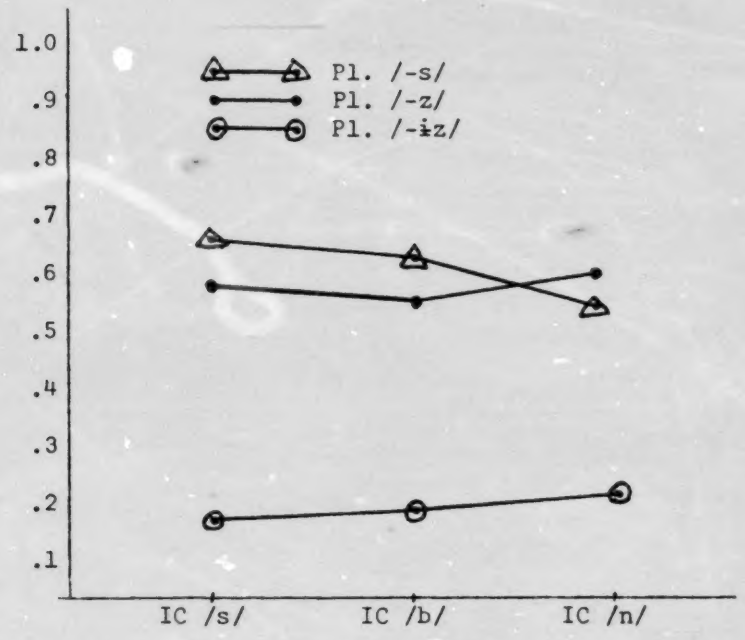

FIGURE 6. Initial Consonant X Plural Allomorph Interaction

The initial consonant X sex interaction was found to be significant with $F = 4.6325$ ($p < .01$ with 2, 232 df). The means for the six levels of this interaction are presented in Table 4. The interaction itself is shown in Figure 7.

TABLE 4. MEANS FOR INITIAL CONSONANT X SEX INTERACTION

	Initial Consonant		
Sex	/s/	/b/	/n/
Male	.5163	.5493	.5408
Female	.4329	.3622	.3727

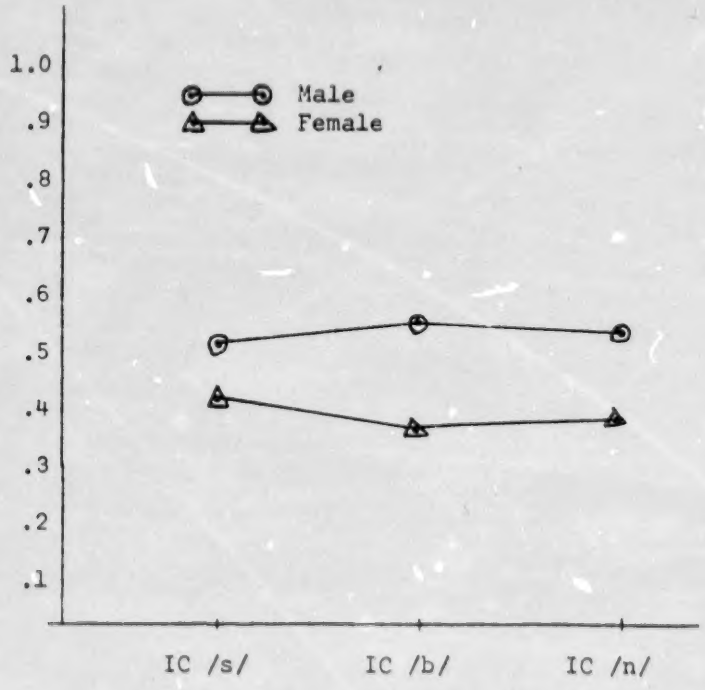

FIGURE 7. Initial Consonant X Sex Interaction

There is a significant plural allomorph X language X sex interaction with $F = 4.1618$ ($p < .05$ with 2, 232 df). This finding could be anticipated in the light of the previously reported significant differences between means for the three component effects making up this interaction. The means for the various levels of plural allomorph, language, and sex are presented in Table 5, and are graphically depicted in Figure 8. Noteworthy here are the consistent differences between means for sex within language; NES males = .6660, NES females = .4775, NSS males = .4089, and NSS females = .31. That is, not only was there a significant sex difference favoring male Ss, but also this sex difference held within the two language groups in question, i.e., both NES and NSS males performed better than their female counterparts.

TABLE 5. MEANS FOR LANGUAGE X SEX X PLURAL ALLOMORPH INTERACTION

	Plural Allomorph		
NES	/-s/	/-z/	/-iz/
Males	.7611	.7983	.4388
Females	.6000	.6105	.2222
NSS			
Males	.6277	.5316	.0555
Females	.4277	.3866	.0888

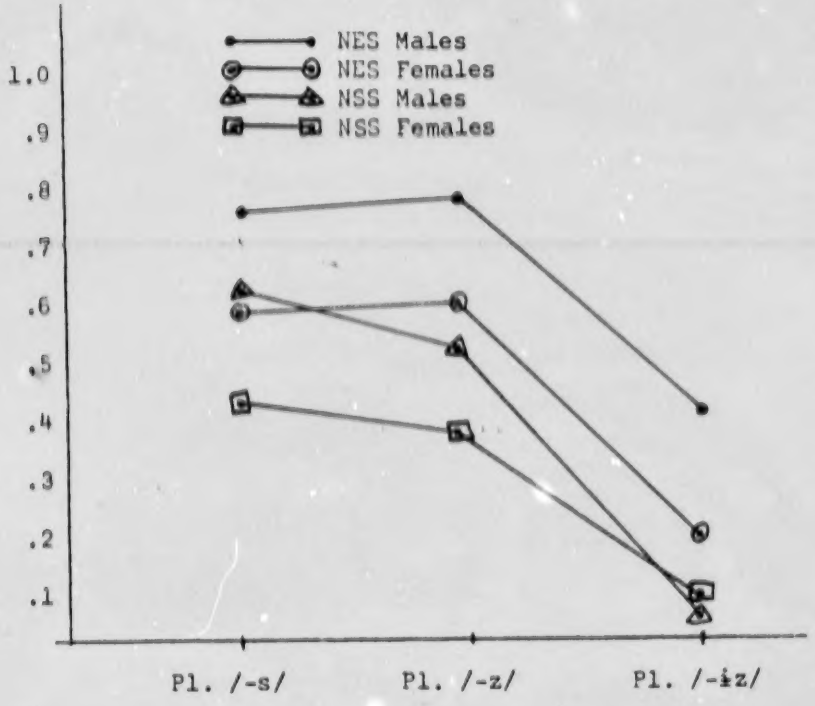

FIGURE 8. Language X Sex X Plural Allomorph Interaction.

Qualitative Analysis

Nature of Children's Pluralization Rules. An important aspect of examining data collected on children's noun pluralizations involves abstracting from the responses of the children a set of noun pluralization rules which adequately account for the observed behavior. For example, Berko (1958) spoke of a possible noun pluralization rule which, simply stated, was that plurals are nouns that end with sibilant consonants. In addition, she concluded that the [voice] feature of the noun plural allomorphs /-s/ and /-z/ was probably determined by a general rule of English phonology which applied not only to noun plurals, but to noun possessives and both present and past tense verb forms as well. Anisfeld and Tucker (1967) were also interested in formulating and subjecting to subsequent investigation rules for noun pluralization which could be said to reflect the data they collected, e.g., "plurals are longer than singulars," "plurals consist of number + singular." Using the observable data, then, the problem facing the researcher is to account for a child's pluralization behavior by deriving generalizations[9] which are suggested by his performance. Both correct pluralizations and pluralization errors in performance are relevant to the formulation of these general pluralization rules.

It is important to mention that only regular English noun plurals are being considered in this discussion. Previous studies (e.g., Graves and Koziol, 1971) have attempted to investigate irregular noun plurals, e.g., foot--feet, and despite the methodological problems involved, e.g., inventing "irregular" English nouns, this would appear to be an interesting area of investigation. One of the principal sources of interest in the area of irregular noun plurals (or irregular verbs) is the fact that these irregular words are usually of high frequency in the language, e.g., go--went, resulting in their irregular form being maintained and in their frequently being learned by children as idiosyncratic items before rules for dealing with regular nouns and verbs are acquired. Consequently, the initial use of the regular pluralization rule is often readily observed because the child begins applying the regular rule to all nouns, including those nouns which had up to that point been pluralized by the child with idiosyncratic forms and to which the application of the regular plural is inappropriate, e.g., foot--foots. This period of acquisition of regular rules is followed by a period in which regular and irregular nouns are distinguished; regular nouns are pluralized with the regular plural allomorphs and irregular nouns according to their own idiosyncratic patterns, which, for some nouns, may mean returning to the form used during the initial stage. Thus, for example, in the first stage the child

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[9]These generalizations do not, of course, describe the process which the child must go through each time he pluralizes a noun, but rather the kind of generalizations which must be available to him in order to enable him to pluralize English nouns successfully.

child may say, "two feet" and "two book"; in the second stage he over-generalizes the regular rule for noun pluralization and says "two foots" as he would say "two books"; in the third stage he would say "two feet" and "two books," making the final discrimination. Although irregular nouns were not included in the data collected in this study, it is clear that a complete description of noun pluralization would have to include not only the three stages in the acquisition of regular noun pluralization proposed here, but also those irregular nouns in English which the child learns before, during, or after the acquisition of rules for regular noun pluralization.

In examining the plural response data collected from the first grade children in this sample, one fact stands out. Either the child pluralized the word correctly, i.e., he "knew" the correct plural form, or he did not pluralize the noun at all, using instead what appeared to be the singular form. There are no examples of "creative" pluralization errors where something other than the correct suffix was used to mark the plural. In other words, it appears that children use the singular form of the noun until such time as they learn the correct plural form, and once the plural form is learned, it is used consistently with all nouns requiring it. These nouns themselves fall into two classes: (1) those to which the /-s/ and /-z/ plural allomorphs are attached; and, (2) those ending in sibilant consonants for which the /-ɨz/ allomorph is the appropriate plural marker. Taken together, these observations suggest three stages in the development of regular noun plurals in children.

The first stage in regular noun plural development involves the use of the noun singular form with a preceding number, e.g., one book, two book, where apparently the number itself is an adequate indicator of the "more-than-one" concept. In this particular kind of plural construction, i.e., one in which a number greater than one precedes the noun, the plural allomorph is a redundant marker of the "more-than-one" concept expressed by the preceding number, and it appears that for the child in this initial stage, the number itself serves adequately to mark the plural. Although in this study no attempt was made to compare nouns occurring with and without preceding numbers to determine whether differences in performance occurred, this field of inquiry was considered in the Anisfeld and Tucker (1967) study. Important in their findings was the fact that the preceding number appeared to be a necessary plural marker only when the plural allomorph itself was not used. Thus, in the first stage when plural allomorphs have not yet been acquired, the number + singular noun is an acceptable plural form. This pluralization strategy expressed as a rule:

PL Rule 1: Pl → Number / _____ Noun

is, as will be seen, modified or completely replaced during the second stage.

In the second stage of the plural acquisition process, the plural allomorphs /-s/ and /-z/ appear to be acquired simultaneously as evidenced by the fact that words such as cat, pluralized with the /-s/ allomorph, and dog, pluralized with the /-z/ allomorph, are both correctly pluralized beginning at about the same time. The resulting general rule for pluralization can be simply described as adding a [+anterior], [+strident], and [+coronal] consonant to the singular noun. This rule relates to Berko's (1958) suggestion that at some stage of development noun plurals may simply be words that end in sibilant sounds.

The concurrent appearance of the /-s/ and the /-z/ allomorphs during the second stage of noun pluralization also provides support for Berko's (1958) suggestion that the rule for the [voice] feature of these allomorphs is a general phonological rule rather than an additional rule involved in noun pluralization. That is, since these two allomorphs, /-s/ and /-z/, which differ only in terms of [voice] begin occurring in children's performances at the same time, it is likely that the pluralization rule involves only the features [anterior], [coronal] and [strident] which /-s/ and /-z/ share, and that [voice] is determined by a general phonological rule in the grammar which governs the [voice] feature of all inflectional suffixes. Additional support for this position is provided by the Anisfeld, Frail and Barlow (1968) and the Anisfeld and Gordon (1968) investigations where features selected by Ss as preferable plural markers included both [+continuant] and [+strident] (shared by /s/ and /z/), but did not include [voice] which differentiates /s/ and /z/. The more general phonological rule,[10] then, automatically applies when the pluralization rule becomes operational, and [voice] is assigned to the plural allomorph according to that general rule.

$$\text{GP Rule 1: } \begin{bmatrix} +\text{anterior} \\ +\text{coronal} \\ +\text{strident} \end{bmatrix} \rightarrow [\alpha \text{ voice}] \; / \; [\alpha \text{ voice}] \; ____$$

In proposing the second stage in plural acquisition, a question arises concerning the sibilant-final nouns which are not at this stage correctly pluralized, correct pluralization being limited to those nouns taking the /-s/ and /-z/ allomorphs. Two interpretations for the role of these sibilant-final nouns during the second stage may be considered. One is that noun singulars which themselves terminate in a sibilant sound, e.g., bus, remain excepted from the application of the plural rule because the stage two rule is restrictive and applies only

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[10]In this discussion, proposed pluralization rules will be noted by the letters PL, and general phonological rules will be indicated by the letters GP.

under conditions which exclude noun singulars ending in a sibilant sound. That is, the sibilant attachment rule characterizing stage two would include a constraint which would have it apply to all nouns except those with a final sibilant. Such a rule would take the form:

$$\text{PL Rule 2(a):}\quad Pl \rightarrow \begin{bmatrix} +\text{anterior} \\ +\text{coronal} \\ +\text{strident} \end{bmatrix} \;/\; \left\{ \begin{matrix} [-\text{coronal}] \\ [-\text{strident}] \end{matrix} \right\} ____$$

According to this interpretation, the absence of plural allomorphs on sibilant-final nouns results from the second-stage rule [2(a)] not being applicable to these nouns because of the constraints on the application of the rule, leaving as the only pluralization strategy for them the earlier number + singular rule (PL Rule 1).

An alternative interpretation is that these sibilant-final singular nouns may be included in the general sibilant addition rule descriptive of the second stage by removing all constraints applicable to that rule, and the process of attaching the plural sibilant to the final sibilant of the singular noun is subsequently blocked by a general phonological rule. Removing all constraints from PL Rule 2(a), the resulting rule is:

$$\text{PL Rule 2(b):}\quad Pl \rightarrow \begin{bmatrix} +\text{anterior} \\ +\text{coronal} \\ +\text{strident} \end{bmatrix}$$

The general phonological rules which would apply to the output of the stage two plural rule as revised [PL Rule 2(b)], would be:

$$\text{GP Rule 1:}\quad \begin{bmatrix} +\text{anterior} \\ +\text{coronal} \\ +\text{strident} \end{bmatrix} \rightarrow [\alpha \text{ voice}] \;/\; [\alpha \text{ voice}] ____$$

GP Rule 2: A general phonological constraint on consonant sequences in English (e.g., prohibiting /s̆s/, /z̆z/, and so on).

According to this interpretation, the apparent omission of plural allomorphs from sibilant-final nouns in a child's performance during the second stage does not represent an exclusion of these final sibilants from the second stage rule, but rather involves the application of this rule and its subsequent blocking on sibilant-final nouns by a general phonological constraint of English. These two interpretations are dealt with in further detail below.

The third stage in the development of regular noun pluralization rules in English would superficially involve separating the sibilant-final singular nouns from all others and attaching the /-ɨz/ allomorph to them.

This process may be accounted for in two alternative ways. First, as suggested above, the sibilants may be excluded from the general pluralization rule of the second stage by limiting the application of this rule to those consonants which are either [-strident] or [-coronal], i.e., making it apply to all noun singular finals except the sibilants. During the second stage, sibilant-final nouns continue to be "pluralized" as are all nouns in the first stage, i.e., with a preceding number. In the third stage of noun pluralization, then, the sibilants are assigned plurals by a rule which indicates that /-ɨz/ is added to them; all other nouns continue to be pluralized by the second stage pluralization rule [PL Rule 2(a)]. This sequence of rules is:

Stage 2:

PL Rule 2(a): $PL \rightarrow \begin{bmatrix} +\text{anterior} \\ +\text{coronal} \\ +\text{strident} \end{bmatrix} / \left\{ \begin{matrix} [-\text{coronal}] \\ [-\text{strident}] \end{matrix} \right\} ____$

Stage 3:

PL Rule 3: $Pl \rightarrow \begin{bmatrix} +\text{voc} \\ +\text{high} \\ -\text{back} \\ -\text{tense} \end{bmatrix} \begin{bmatrix} +\text{anterior} \\ +\text{coronal} \\ +\text{strident} \end{bmatrix} / \begin{bmatrix} +\text{coronal} \\ +\text{strident} \end{bmatrix} ____$

Alternatively, and preferable in terms of both the parsimony and elegance of the description and the observable data is the interpretation that final sibilants are, during the second stage, included in the more general pluralization rule involving the addition of a sibilant to the noun singular [PL Rule 2(b)], and that the sequence which results is subsequently blocked. In other words, in the second stage the sibilant + sibilant sequence resulting from PL Rule 2(b) is blocked by a more general phonological rule which prohibits such sequences in English, and the addition of the noun plural allomorph to noun singulars is effectively limited to non-sibilant-final nouns by this general rule. Subsequently, in the third stage a means for dealing with sibilant-final noun singulars is developed to permit the marking of the pluralization of these nouns by means of an additional general phonological rule which inserts a vowel having the features [-back], [+high], and [-tense] whenever a non-permissible sound sequence results in the output of PL Rule 2(b). Like the rule which initially blocks the application of the second stage plural rule, this rule for vowel-insertion (GP Rule 3) would be a general phonological rule rather than a rule applicable only to noun plurals since the same vowel-insertion process is involved in noun possessives, e.g., "witch's", and present tense verbs, e.g., "he watches." Generally speaking, these

two general phonological rules would take the form:[11]

GP Rule 3:[12] $\emptyset \rightarrow \begin{bmatrix} +\text{voc} \\ +\text{high} \\ -\text{back} \\ -\text{tense} \end{bmatrix} / \begin{bmatrix} +\text{coronal} \\ +\text{strident} \end{bmatrix} _____ \begin{bmatrix} +\text{coronal} \\ +\text{strident} \end{bmatrix}$

GP Rule 1: $\begin{bmatrix} +\text{anterior} \\ +\text{coronal} \\ +\text{strident} \end{bmatrix} \rightarrow [\alpha \text{ voice}] / [\alpha \text{ voice}] _____$

Evidence from the data collected here tend to support this interpretation. Plural responses to nonsense syllable stimuli ending in /s/ and /z/ revealed an occasionally perceptible lengthening of the final /s/ or /z/; i.e., Ss who were correctly pluralizing other final consonants with the /-s/ and /-z/ allomorphs seemed sometimes to be trying to apply the second-stage sibilant-addition rule [PL Rule 2(b)] for pluralization to all singular nouns, including those with final sibilants. In the case of final /s/ or /z/, this attempt to add the plural sibilant to the sibilant-final singular resulted in the perceptible lengthening of the noun singular final sibilants, e.g., bus + s = /bəs:/. The attempted addition of a plural /-s/ or /-z/ to a noun singular ending in sibilants other than /s/ and /z/, i.e., /š/, /ž/, /č/, /ǰ/, without introducing the necessary vowel between them, did not occur in the Ss' performances, and can perhaps be accounted for by the fact that although the lengthening of many English consonants is possible in cases of emphasis, stress, or language play (e.g., children can describe the noise that a bee makes as "buzzz", /bəz:/), sequences such as /čs/, /ǰz/, /šs/, and /žz/ never occur in English.

In summary then, the rules for English noun pluralization as these are acquired in three stages can be characterized as follows:

Stage 1:

PL Rule 1: Pl → Number / _____ Noun

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[11]The rules must be applied in this particular order in order to produce correct phonetic output.

[12]In addition, in a complete grammar of English this rule would have to be even more generally stated to permit its application to past tense and past participle forms of verbs, e.g., "he waited," and "he has waited."

Stage 2:

PL Rule 2(b): Pl → [+anterior, +coronal, +strident]

GP Rule 1: [+anterior, +coronal, +strident] → [∝ voice] / [∝ voice] _____

GP Rule 2: A general phonological constraint on consonant sequences in English (e.g., prohibiting /šs/, /žz/, and so on).

Stage 3:

PL Rule 2(b): Pl → [+anterior, +coronal, +strident]

GP Rule 3:[13] ∅ → [+voc, +high, -back, -tense] / [+coronal, +strident] _____ [+coronal, +strident]

GP Rule 1: [+anterior, +coronal, +strident] → [∝ voice] / [∝ voice] _____

PL Rule 1 is universally applied during the first phase of plural development resulting in such expressions as "two car." PL Rule 2(b) is introduced during the second phase when all noun plurals are formed by adding a sibilant to the final consonant of the noun singular, e.g., /kit/→/kits/. [Voice] is assigned to this sibilant by GP Rule 1 in Stage 2, resulting in /kits/ and /kidz/. Final sibilants are included in the application of PL Rule 2(b), but a more general rule of English phonology (GP Rule 2 in Stage 2) blocks the sound sequence which results when the plural sibilant is added to a noun singular ending in a sibilant, e.g., /*wics/. In order to pluralize these sibilant-final nouns the plurals of which are blocked in Stage 2 by a constraint of the phonology (GP Rule 2 in Stage 2), a general phonological rule is introduced in the third stage which inserts a vowel between the final sibilant of the noun singular and the sibilant representing the noun plural so that, for example:

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[13]To produce correct phonetic output, the vowel-insertion rule must precede the rule which assigns [voice]. The general phonological constraint (GP Rule 2 in Stage 2) no longer applies in Stage 3 because this vowel-insertion rule eliminates the possibility that sound sequences of the type /šs/ will be produced.

/wiĭ/ → /wiĭ $\left\{\begin{matrix}s\\z\end{matrix}\right\}$ / [PL Rule 2(b)]

/wiĭ $\left\{\begin{matrix}s\\z\end{matrix}\right\}$ / → /wiĭi $\left\{\begin{matrix}s\\z\end{matrix}\right\}$ / [GP Rule 3]

/wiĭi $\left\{\begin{matrix}s\\z\end{matrix}\right\}$ / → /wiĭiz/ [GP Rule 1]

It will be noted that the rules presented here to characterize the development of regular noun pluralization in English are similar to those which were earlier used to describe English noun pluralization [cf. footnote 1]. These rules differ in two principal ways from the originally stated adult rules: (1) PL Rule 1 described here represents the pre-plural developmental stage where there is not yet a formal plural marker on the noun itself. In later stages, this rule would be replaced by PL Rule 2(b) which is identical to the first rule in footnote 1. (2) There are rules for the [voice] feature and for the vowel insertion between sibilant + sibilant sequences in the original description of the plural as it appears in footnote 1. These rules, as has previously been discussed, must be included in any complete description of noun plurals when no other part of the grammar is presented. It does appear, however, that both the [voice] rule and the vowel-insertion rule would perform similar functions for other English inflectional endings, e.g., past and present tense verb forms, and accordingly, would necessarily be more general phonological rules of the grammar rather than being restricted to noun pluralization exclusively.

It will also be noted that PL Rule 1 characterizes the number + singular noun stage discussed by Anisfeld and Tucker (1967). PL Rule 2(b) fits the description of plurals as being nouns that end in sibilants first suggested by Berko (1958) and later confirmed by the investigations into the feature specification of plurals conducted by Anisfeld and Gordon (1968) and Anisfeld, Barlow, and Frail (1968). There would appear to be a contradiction between Anisfeld and Tucker's (1967) conclusions concerning the number + noun singular use for some nouns after the beginning of the second stage, and the conclusion reached here that PL Rule 1 is replaced by PL Rule 2(b) when stage 2 begins. The contradiction is probably only apparent, however, because it is probable that during the transition between stages one and two there may be some instability in assigning noun plurals. In addition, and probably more importantly, it is probable that PL Rule 2(b) is applied to all noun singulars beginning in stage 2 and that

a more general phonological rule blocks any resulting sibilant + sibilant sequence. Then, although it may appear that PL Rule 1 continues to operate on the sibilant-final noun singulars after PL Rule 2(b) is applied to all other nouns, it is the more general phonological rule (GP Rule 2 in Stage 2) which, in fact, operates on the output of PL Rule 2(b) and prevents the sequence which results from applying PL Rule 2(b) to sibilant-final nouns.

Comparison of Native English and Native Spanish Speakers. A second important question addressed by this study involves the differences, if any, between the pluralization strategies utilized by native English and native Spanish speaking children. Since for native Spanish speaking children, English is acquired as a second language, it is possible that certain interference phenomena would be observed in the native Spanish speaking children's performances. That is, some aspects of Spanish may find their way into the child's English performance and thereby affect either his success in acquiring English or the sequence in which he acquires certain aspects of English.

Confirming results of an earlier study (Natalicio and Natalicio, 1971), no evidence was found for the effects of Spanish noun plurals on English noun plurals, i.e., native Spanish speaking children did not use Spanish pluralization strategies in pluralizing English nouns, e.g., Spanish /pan/ → /panes/ never resulted in an analogous English pattern, /pæn/ → /*pænes/.

In terms of the order of acquisition of English plurals by native Spanish speakers, language group means of responses of the first grade Ss in this study support the finding that the order of acquisition, if followed through apparent time as in the Natalicio and Natalicio (1971) study, is the same for both NES and NSS children, with the NSS children acquiring each of the noun plural rules approximately one year later than their NES counterparts. That is, although the English rules are acquired at a somewhat later age when English is learned as a second language, the rules are nevertheless the same rules as those depicted above for NES children, and the pattern of plural errors for the two groups (NES and NSS) is very similar.

One apparent effect of interference from Spanish on English noun pluralization reflected in the data is that Spanish speaking children in this first grade sample had greater success pluralizing nonsense syllables which required the /-s/ allomorph than they did those requiring the /-z/ allomorph (means = .5277 and .4591, respectively). This pattern is different from that of the NES Ss where with a very slight advantage to the /-z/ allomorph, /-s/ and /-z/ allomorphs show almost no difference (means = .6805 and .7044, respectively). The greater difference between

the means for these two allomorphs for the NSS Ss and their greater success at using the /-s/ allomorph can probably be accounted for by the fact that in Spanish [z] does not occur in utterance-final position. Thus, it appears that a phonological constraint of Spanish which permits [z] only when followed by a [+voice] consonant, e.g., mismo -- [mizmo], (and thus never in utterance-final position), may have affected the performance of the NSS Ss in pluralizing nouns which require the /-z/ allomorph.

The only other evidence of the possible effects of interference of Spanish on English in the performances of the NSS Ss in this study occurs in the pattern of errors in the singular repetitions of the nonsense syllables. As has been indicated earlier, the pattern of pluralization errors for both groups was the same, i.e., either the correct plural was provided or an apparent singular repetition was preceded by the number "two." In the singular repetitions of the nonsense syllables, however, there is evidence that Spanish affected the performances of the NSS Ss. In terms of the singular repetitions of the nonsense syllables, NES Ss' errors were concentrated on two specific final consonants, /θ/ (28/60 Ss) and /ð/ (30/60 Ss), and in almost all cases, these two consonants were replaced by /f/ and /v/, respectively. It should be noted that for NES children substitutions for these two consonants are common at this age level; /θ/ and /ð/ are among the last English consonants to be acquired, and the most common substitutions for them are /f/ and /v/. No other final consonants were replaced by NES Ss except insofar as these substitutions were apparent slips of the tongue, occasional misperception of E's stimulus, or an occasional normalization of the nonsense syllable to a real word, e.g., /sub/ → [suwp].

In the case of the NSS Ss there also were many instances of replacements for /θ/ (26/60 Ss) and /ð/ (23/60 Ss), confirming the developmental nature of this error. On the other hand, there was greater variety in what was substituted by NSS Ss for these two consonants than was the case with NES Ss who without exception used /f/ and /v/, thus indicating greater instability in the control over English phonological features on the part of the NSS Ss. That is, the range of substitutable consonants for /θ/ and /ð/ is strictly limited for the NES children who have already learned the majority of the distinctive features of English; /f/ and /v/ are distinguished from /θ/ and /ð/ only by the features [coronal] and [strident]. The NSS children are undoubtedly far less familiar with English features and consequently their range of substitutable consonants is less restricted by the basic feature distinctions. In addition to the greater variety of substitutions used by NSS Ss for /θ/ and /ð/, these Ss also showed consistency in substituting other final consonants not replaced by NES Ss. For example, 16 NSS Ss replaced final /ž/ with another sibilant, either /č/ or /ǰ/, and ten substituted /č/ for /š/. Examining Spanish phonology, it is noted that neither /ž/ or /š/ occurs in Spanish, and substitutions such as those occurring in these data are described in the contrastive

literature as common substitutions resulting from the interference of the Spanish sound system on English [cf. Stockwell and Bowen, 1965].

In conclusion, although there is no evidence to support the notion that Spanish pluralization patterns affect the English noun plural performance of NSS Ss, the effects of a native Spanish-speaking background are revealed in these data in terms of consonant substitutions which occur in reproducing the singular stimuli and in greater success in using the /-s/ allomorph.

Effect of Initial Consonants. In analyzing the data of this study quantitatively it was found that the initial consonant had no significant effect on the successful pluralization of nonsense syllables. It is interesting to examine in the light of these results possible reasons why Guess et al. (1968) reported the anecdotal observation that initial /s/ seemed to cause S greater difficulty in successful pluralization, as well as why it appeared to the present investigators and to teachers with whom they have had contact that initial sibilants confuse children when they attempt to pluralize nouns.

In examining the responses given by both groups of Ss, one factor concerning initial consonants stands out. Initial /s/ when paired with a final sibilant in a nonsense syllable was more often misarticulated, e.g., a nonsense syllable such as /sas/ would be repeated as /šas/, than were the other two initial consonants (/b/ and /n/) when they were paired with any of the 24 final consonants. And, when initial /s/ was paired with a final sibilant, there were more misarticulations of the final sibilant than there were when the other two initial consonants were paired with them; in many such cases the initial and final sibilants were reversed or completely changed. For example, a nonsense syllable such as /saš/ was repeated by several Ss, both NES and NSS, as /šas/, where initial and final sibilants were reversed. Complete substitution of both initial and final sibilants included examples such as /sič/ →/šiz/; /saǰ/ → /čaš/.

The explanation for these phenomena probably lies in the fact that sibilants have a high level of confusability at the age level from which these Ss were selected (Palermo and Molfese, 1972), and their close proximity in a nonsense syllable trigram creates a situation where the possibilities for such confusability are maximized. It is to be noted that this confusability is also exploited in tongue-twisters such as "She sells seashells by the seashore."

In summary, it appears that although there is no significant effect of the initial sibilant, in this case /s/, on successful noun pluralization, it does appear that the confusability of sibilants does tend to result

in an increase in articulation errors, especially when two sibilants occur in close proximity to each other. When an initial sibilant is paired with any final consonant except a sibilant, no particular pattern of articulation problems is evident, and errors can probably be attributed to chance misarticulations. When an initial sibilant is paired with a final sibilant, however, their high confusability and close proximity tend to cause predictable articulation errors. Since the number of English nouns which in a single syllable contain both an initial and a final sibilant is relatively small, e.g., switch, stitch, sash, the pedagogical implications of this observation are probably minor. Certainly, as far as noun pluralization in general is concerned, the presence of an initial sibilant in the singular noun should not be considered a significant factor.

CONCLUSIONS

The major findings of this study may be summarized as follows:

1. Contrary to the results of all earlier studies, first grade males (both NES and NSS) are more successful at the pluralization of nonsense syllables than are first grade females.

2. The /-s/ and /-z/ plural allomorphs are used by children, both native English and native Spanish speaking, before the /-ɨz/ allomorph.

3. There is no significant difference between the effects of the three initial consonants, /s/, /b/, and /n/, on successful noun pluralization.

4. To account for the noun pluralization behavior observed in this study, the following developmental noun pluralization rules are proposed:

Stage 1:

PL Rule 1: Pl → Number / _____ Noun

Stage 2:

PL Rule 2(b): $Pl \rightarrow \begin{bmatrix} +\text{anterior} \\ +\text{coronal} \\ +\text{strident} \end{bmatrix}$

GP Rule 1: $\begin{bmatrix} +\text{anterior} \\ +\text{coronal} \\ +\text{strident} \end{bmatrix} \rightarrow [\alpha \text{ voice}] \quad / \quad [\alpha \text{ voice}] _____$

GP Rule 2: A general phonological constraint on consonant sequences in English (e.g., prohibiting /s̆s/, /z̆z/, and so on).

Stage 3:

Pl Rule 2(b): $Pl \rightarrow \begin{bmatrix} +\text{anterior} \\ +\text{coronal} \\ +\text{strident} \end{bmatrix}$

GP Rule 3: $\emptyset \rightarrow \begin{bmatrix} +\text{voc} \\ +\text{high} \\ -\text{back} \\ -\text{tense} \end{bmatrix} \quad / \quad \begin{bmatrix} +\text{coronal} \\ +\text{strident} \end{bmatrix} _____ \begin{bmatrix} +\text{coronal} \\ +\text{strident} \end{bmatrix}$

GP Rule 1: $\begin{bmatrix} +\text{anterior} \\ +\text{coronal} \\ +\text{strident} \end{bmatrix} \rightarrow [\alpha \text{voice}] \; / \; [\alpha \text{voice}] \; _____$

5. Although there is no evidence to support the notion that Spanish pluralization patterns affect the English noun plural performance of NSS Ss, the effects of a native Spanish-speaking background are revealed in these data in terms of consonant substitutions which occur in reproducing the singular stimuli and more successful pluralizations with the /-s/ allomorph than with the /-z/ allomorph.

6. Although there is no significant effect of the initial sibilant, in this case /s/, on successful noun pluralization, the confusability of sibilants does tend to result in an increase in articulation errors, especially when two sibilants occur in close proximity to each other as in such words as switch and stitch. Since the number of such words in English is relatively small, the pedagogical implications of this observation are probably minor.

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